Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2015/013

Central and Arctic Region

Proceedings of the regional peer review of the assessment of Arctic Char in the Darnley Bay area of the Northwest Territories

February 6-7, 2014
Winnipeg, Manitoba

Chairperson: Margaret Treble
Editor: Colin Gallagher

Fisheries and Oceans Canada
501 University Crescent
Winnipeg, Manitoba, R3T 2N6

January 2016

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

© Her Majesty the Queen in Right of Canada, 2016
ISSN 1701-1280

Correct citation for this publication:

DFO. 2016. Proceedings of the regional peer review of the assessment of Arctic Char in the Darnley Bay area of the Northwest Territories; February 6-7, 2014. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2015/013.

TABLE OF CONTENTS

SUMMARY iv

SOMMAIRE iv

INTRODUCTION 1

DETAILED DISCUSSION 1

- PRESENTATION 1: BACKGROUND 1
- PRESENTATION 2: MODELLING 2
- PRESENTATION 3: HABITAT USE 3
- PRESENTATION 4: STOCK STRUCTURING 4
- PRESENTATION 5: MONITORING HORNADAY RIVER AND LASARD CREEK 5
- PRESENTATION 6: MONITORING TIPPITIUYAK 6
- PRESENTATION 7: COMMUNITY HARVEST 7
- DEVELOPMENT OF SCIENCE ADVISORY REPORT (SAR) 7
- NEXT STEPS 7

APPENDIX 1: PARTICIPANTS 8

APPENDIX 2: TERMS OF REFERENCE 9

APPENDIX 3: AGENDA 11

SUMMARY

A Regional Advisory Process was held at the Freshwater Institute in Winnipeg to assess Arctic Char (*Salvelinus alpinus*) from Darnley Bay, Northwest Territories. The meeting was held on February 6 and 7, 2014 and included participants from Fisheries and Oceans Canada, Fisheries Joint Management Committee, the Paulatuk Hunters and Trappers Committee, University of Manitoba, and an independent expert. During the meeting, multiple presentations were made on various topics relevant to the assessment and included a description of the current subsistence fishery and past attempt at a commercial fishery, the methods used to collect a standardized multi-year data set for the assessment of char from the Hornaday River, the modelling of the data using three models to predict the current level of exploitation and stock status, freshwater and marine habitats utilized by char, a genetic mixed-stock fishery analysis, a summary of catch-effort and/or biological data of char captured from three main harvesting locations in Darnley Bay during the summer, and the results of an annual harvest survey of char (all harvesting locations in Darnley Bay) from the community of Paulatuk. The meeting accomplished its objectives of providing science advice to co-management partners, most importantly an estimate of maximum sustainable yield. Publications from the meeting included a Science Advisory Report and multiple Research Documents.

Compte rendu de l'examen régional par les pairs de l'Évaluation du stock d'ombles chevaliers dans la région de la baie Darnley, dans les Territoires du Nord-Ouest

SOMMAIRE

Un processus de consultation régional s'est déroulé à l'Institut des eaux douces, à Winnipeg afin d'évaluer l'omble chevalier (*Salvelinus alpinus*) de la baie Darnley, dans les Territoires du Nord-Ouest. La réunion, qui s'est tenue les 6 et 7 février 2014, a rassemblé des participants de Pêches et Océans Canada, du Comité mixte de gestion de la pêche, du Comité de chasseurs et de trappeurs de Paulatuk, de l'Université du Manitoba et un expert indépendant. Plusieurs exposés ont été présentés pendant la réunion sur différents thèmes pertinents pour l'évaluation; ils décrivaient notamment : la pêche de subsistance actuelle et les tentatives passées de pêche commerciale; les méthodes employées pour la collecte d'un ensemble de données normalisé sur plusieurs années aux fins d'évaluation de l'omble chevalier dans la rivière Hornaday; la modélisation des données au moyen de trois modèles pour prévoir le niveau d'exploitation actuel et l'état du stock; les habitats marins et d'eau douce utilisés par l'omble chevalier; une analyse génétique de la pêche de stocks mélangés; un résumé de l'effort de pêche et des données biologiques sur les ombles chevaliers capturés dans trois principaux lieux de pêche de la baie Darnley en été, et les résultats d'une enquête sur la pêche annuelle (de tous les lieux de pêche de la baie Darnley) par la collectivité de Paulatuk. La réunion a atteint ses objectifs, qui consistaient à donner un avis scientifique aux partenaires de cogestion et, surtout, une estimation du rendement maximal soutenu. Les publications de la réunion comprennent un avis scientifique et plusieurs documents de recherche.

INTRODUCTION

The purpose of the peer-review was to assess the status of anadromous Arctic Char from the Hornaday River using biological and catch-effort data collected from a harvest-based monitoring program. Monitoring was conducted annually between 1990 and 2013 during the upstream migration. Additional information from recent sampling programs at other locations in Darnley Bay were also included to improve the assessment and characterize the char harvested from the majority of important harvesting locations in the bay during the summer. The meeting began with introductions of participants (Appendix 1), a review of the terms of reference for the meeting (Appendix 2), and a review of the agenda (Appendix 3).

DETAILED DISCUSSION

PRESENTATION 1: BACKGROUND

ARCTIC CHAR IN DARNLEY BAY: BACKGROUND

Presenter: Colin Gallagher

Participants were given an overview of the Hornaday River and Brock River systems which drain into Darnley Bay and provide freshwater habitat to stocks of anadromous Arctic Char that are thought to contribute the most to the subsistence fishery. Information on the timing and location of the winter and summer fisheries that occur in Darnley Bay and the Hornaday River was also provided. Harvest data, quotas, and biological data from a past commercial fishery (1968-1986) which occurred at the mouth of and/or in the Hornaday River, and the estimated subsistence harvest levels between 1968 and 2002 were summarized. Past studies were described including test fisheries at various locations in the Darnley Bay area, enumeration of char in the Hornaday using a weir, locating spawning habitat in the Hornaday, and the Hornaday River Char Monitoring Program. The annual Hornaday River Char Monitoring Program was established in 1990 with the objective to collect harvest, biological, and catch-effort (1997+) information from Arctic Char caught at the mouth of the Hornaday River during their migration from the sea to freshwater during late-July to the end of August. More recent data collection programs in Darnley Bay were conducted at the mouth of Lasard Creek and at Tippitiuyak (Tippi). A description of the data collected by the monitoring program at the Hornaday River from 1990 to 2013 was also provided. Finally, important management milestones for the Hornaday River stock were summarized. The presentation gave participants the necessary background on the stocks, fishery, and data available for the assessment.

DISCUSSION

A few participants clarified some of the information that was presented and also provided additional background information. One participant stated that the way in which the sea ice moved during the spring thaw had changed over the past 10 years because of the warming climate. During spring it is easier to capture char when there is ice in the area but in recent years the ice close to shore does not remain as long as it used to thereby increasing the difficulty in catching char. Harvesters in Paulatuk believe 'blue char' are a separate stock which has been observed in Darnley Bay for over 40 years. These char do not look like the typical 'river' char captured at the mouth of, or in, the Hornaday River. It was also stated that 'blue char' were also captured in the Lasard Creek area and some people have reported catching 'blue char' in the Hornaday River. A concern was raised over how the reported change in flows of the east channel in the Hornaday River delta may be affecting the monitoring program catch-effort results at this location.

PRESENTATION 2: MODELLING

MULTI-MODEL ASSESSMENT OF ANADROMOUS ARCTIC CHAR IN THE HORNADAY RIVER

Presenter: Xinhua Zhu

Exploitation rate and stock status for Arctic Char from the Hornaday River were examined using three different models (depletion-based stock reduction analysis, surplus production, and statistical-catch-at-age) with Harvest (1968-2013), biological (1973-2013), and catch-effort (1997-2013) data from the Hornaday River Char Monitoring Program. The methods used to standardize the catch-effort data among month of capture, hours fished, net length, and mesh sizes were reviewed. The presenter explained the manner in which estimates of growth and natural mortality were calculated. Data requirements and assumptions for each model, the interrelationships among certain stock production variables, and software utilized to run the models were also described. Each model yielded estimates of the biomass (total number and weight) of fish in the population (K), maximum sustainable yield (MSY), average maximum sustainable yield (A_{MSY}), maximum rate of fishing mortality (F_{MSY}), and equilibrium exploitation rate at MSY (U_{MSY}). A single MSY value was estimated by using the geometric mean among models. The models suggested that there were instances of overharvest in the past, however the current level of harvest appears to be below MSY and the stock status is healthy. The statistical-catch-at-age model also provided estimates of spawning stock biomass. Some of the uncertainties associated with the data used in the models included accuracy of the harvest survey in estimating the number of char that were harvested, precision of fish ages, low sample size in some years, representativeness of the biological sample, and the effect of the contribution of char from the Brock River stock to the Hornaday River.

DISCUSSION

The presenter was asked to clarify what criteria were used in the selection of catch-effort records used in the models and whether there was a significant difference in the length-at-age relationship between males and females. In response, the presenter indicated that catch-effort records were restricted to nets set for 12 hours and data used in generating growth curves were restricted to samples captured in mesh sizes between 133 and 152 mm which resulted in a lack of data for ages <4 years.

One participant was aware of a possible bias in fish ages between readers and asked how this bias might affect the model output. The presenter replied that data from a single age reader was used so no adjustment was made.

After confirming that MSY and F_{MSY} were based on fishery equilibrium assumptions it was noted that the development of the fishery could be simulated in order to determine the sensitivity of these values and evaluate whether they were possibly overestimated. A concern was voiced that the 95% confidence intervals for abundance and biomass were close to zero. However, it was mentioned that these results were a product of the model-types and their assumptions. Subsistence harvest data for 2003 to the present was not available prior to the meeting and so a level of 1700 char was used in the models. Participants suggested that the models be re-run using the harvest data presented at this meeting. One participant also stated that the subsistence harvest reported for the years prior to the closure of the commercial fishery were likely not very accurate.

The presenter explained that the different assumptions and data used in each model resulted in different estimates of MSY. It was suggest that clarification of the sources of uncertainty in the models would help others evaluate their output (including MSY). One participant recommended

using an inverse-variance weighting given the various levels of precision and amount of data used among models to estimate a final MSY value instead of taking a geometric mean.

It was observed that the fishing mortality predicted by the models appeared lower than what would be expected given the mortality observed in the Robson-Chapman estimates of annual mortality described in a separate working paper. When asked to comment on the apparent discrepancy, the presenter stated that the statistical-catch-at-age model used to estimate fishing mortality assumed a constant age specific mortality rate over all years. It would be possible to run the model again with variable fishing mortality. However this would introduce additional error.

A participant asked whether it would be possible to incorporate fisher's knowledge in order to address some of the uncertainties in the models. The presenter answered that this could be possible and an interesting exercise for future work. A final statement was made by a participant that the ambitious comparisons of three models was done thoroughly, however there was a need for more detailed precision statements prior to a final decision on MSY and that it would be premature to pick one model over another.

PRESENTATION 3: HABITAT USE

OVERWINTERING, SPAWNING AND SUMMER FEEDING HABITATS USED BY ANADROMOUS ARCTIC CHAR OF THE HORNADAY RIVER

Presenter: Lois Harwood

Radio (1995, 1996 and 1999) and t-bar (1987, 1997, and 1999) tagging has been conducted to identify Arctic Char movements and seasonal habitat usage in the Hornaday River. The objective of the study was to identify spawning and overwintering locations in the river (radio tags) and coastal movements during the summer (t-bar tags). The results indicated that a 16 km stretch of the Hornaday River between Akluk Creek and an area called Coalmine was important for overwintering and presumably for spawning. This stretch of the river is known to have perennial groundwater springs. One deep area of the Hornaday River delta also appears to provide overwintering habitat. The t-bar tagging project not only indicated that Pearce Point is an important feeding area but that during the summer the eastern coast of Darnley Bay is more often used by char than the western coast. Further research is needed to characterize the physical properties of overwintering habitat and clearly delineate spawning locations.

DISCUSSION

One of the participants from the community of Paulatuk mentioned that at some of their winter fishing locations in the Hornaday River can be 10 to 15 feet deep with a rocky bottom. The other participant from Paulatuk mentioned that there has been less water in the "wintering holes" (locations where Arctic char overwinter) and in some years it was too shallow to set nets. It was believed that the river gauge further upstream near the border of Tuktut Nogait National Park was not providing information that corresponded with what harvesters were observing at the "wintering holes" and noted that there used to be 20 to 30 feet of water in some areas. The presenter noted that the overwintering locations were fed by perennial springs that flow year round and that it is possibly these flows that may have changed which would not be reflected in the information provided by the gauge. A participant asked whether smolts were ever observed in the river and a Paulatuk community representative stated that juvenile fish were seen at the "wintering holes" when jiggling (a form of angling) during the winter.

It was noted that Arctic Char do not spawn annually and most current-year spawning char do not migrate to sea. There was a question and some concern that this could affect the estimation of population size generated by models that use relative abundance data from the mouth of the

Hornaday River. One participant commented that the spawning stock likely comprised a small proportion of the population while another stated that most population models assumed annual spawning and adjustments should be made to the model if this is not the case. It was stated that it would be important to determine the spawning frequency of char during its lifetime as this was a significant gap in our understanding of char life-history. The presenter also reminded participants of the important scientific contributions to our understanding of the Hornaday River char stock that have been made by Al Kristofferson who conducted test fisheries and commercial fishery sampling programs, and Pierre Lemieux and Vic Gillman who initiated the original monitoring program in 1988.

PRESENTATION 4: STOCK STRUCTURING

GENETIC STOCK IDENTIFICATION AND MIXED-STOCK FISHERY ANALYSIS OF ARCTIC CHAR IN DARNLEY BAY, NORTHWEST TERRITORIES

Presenter: David Boguski

Arctic char sampled from the east coast of Darnley Bay where the subsistence harvest predominantly occurs (mouths of Hornaday River and Lasard Creek) were compared to Arctic char sampled from the Brock and Hornaday rivers (two source populations) using genetic mixed-stock fishery analysis. The objectives were to characterize allelic richness among sampling sites and years and to determine whether both source populations were genetically distinct. If the source populations were distinct then the next step would be to estimate the percent contribution of the two stocks to the harvest at both costal locations between 2009 and 2012. Arctic char from the Brock and Hornaday rivers were genetically distinct although there was evidence of gene flow between both systems. The eastern coastal subsistence summer fishery was found to harvest fish from both populations although char from the Hornaday River consistently contributed the most to the harvest. At both harvesting locations and among all sampling years, char from the Hornaday River contributed 80% (average among sampling years) or more to the harvest. The results indicated annual stability in the contribution rates and suggested that the Brock River population was likely smaller than the Hornaday River population.

DISCUSSION

A low level of allelic richness was observed at one of the coastal sites in one of the sampling years and this was thought to be due to low sample size rather than the contribution of other stocks to the fishery at that site. It may be possible that there are char stocks in the Horton, Roscoe, and Croker rivers that could also contribute to the fishery. However, it was stated that the results showing the considerably higher contribution of Arctic char from the Hornaday River to the coastal fishery are in agreement with the local knowledge that this stock is the largest and would contribute the most to the fishery.

Participants discussed the possibility of whether or not the temporal stability observed in the stock contributions to the harvest could be used as an index of stock abundance and if so then future monitoring and assessment activities might be adjusted accordingly. It was stated that using future mixed-stock fishery analyses as a means to monitor population status of both the Brock River and Hornaday River was unlikely due differences in catch-effort and sampling, variation in the timing of the fishery, and environmental conditions which may affect movements.

The presenter confirmed that that both stocks were sufficiently genetically distinct to use the statistical methods to estimate contribution. It was also stated that genetic mixture analysis was used to estimate contribution rates and not assignment tests, which should help address artefacts of sampling. The genetic architecture of the sample was examined in order to assign a

group to a population as opposed to assigning an individual fish to a population. It was stated, however, that assignment tests might be worth doing as it would provide an indication whether more populations were present in the coastal fishery. A participant who asked whether there could be a morphological difference between Arctic Char from the Brock and Hornaday rivers was told that the geographic proximity of these rivers, low level of genetic differentiation, and evidence of gene flow between both rivers, would have a homogenizing effect on local adaptations and therefore morphological differences would not be expected.

PRESENTATION 5: MONITORING HORNADAY RIVER AND LASARD CREEK

MONITORING OF ARCTIC CHAR FROM HORNADAY RIVER AND LASARD CREEK: CATCH EFFORT AND BIOLOGICAL INFORMATION

Presenter: Colin Gallagher

Results were presented from an age comparison study that examined differences between:

1) two age readers using the whole otolith ageing method; and
2) the whole otolith and section ageing methods when applied by a single age reader.

When examining whole otoliths, differences between readers were apparent starting at age seven with the ages of the first reader consistency lower than the second reader suggesting both readers interpreted annuli differently among older ages. A higher number of annuli were counted for fish ≥10 years when using thin sections compared to whole otoliths. These differences between age readers and methods would have an effect on estimates of growth and mortality of the population.

Time series data on harvest reported by the monitors, catch-effort (1997+ for Hornaday), and biological data for Hornaday River (1990-2013) and Lasard Creek (2011-2013) were analyzed. The effects of mesh size on catch-effort and length of captured char were examined. Median daily and annual catch-effort was plotted by day and year, respectively, for both monitoring programs in order to evaluate trends as an indication of stock status. Biological data were examined to assess changes over time in length and age structure, weight, condition, sex ratio, growth, and annual mortality (estimated using the Robson-Chapman method). The Hornaday river harvest is currently comprised of a wide range of sizes with a high proportion >600 mm that are predominantly between 6 to 8 years of age. Median length, weight and condition have been stable while growth has not changed considerably over the past 10 years. Although annual mortality appeared to be increasing, it was still within the range observed between 1993 and 1995. There is no indication of a decline in status and the current harvest level appears to be sustainable.

While the time-series for Lasard Creek was shorter than the Hornaday River, the results showed that harvest was higher at this location in some years. Peak catch-effort was similar between locations in most years but occurred on different days. Biological characteristics between sites were also similar which was expected given the results from the genetic mixed stock fishery analysis.

DISCUSSION

The calculation and interpretation of the annual mortality metric was discussed at length. Annual mortality was calculated using the Robson-Chapman method however, results from catch-curve analyses were also presented for comparison. A point was made that catch-curve analysis assumes the mean and variance in modal age remains the same, which is not always the case, therefore trends should be examined with models such as Virtual Population Analysis (VPA). Additionally, the age data are likely not independent among years which is a factor that should

be incorporated in the methods used in evaluating trends. The reason for the discrepancy in mortality estimates between the statistical-catch-at-age model (mortality is decreasing) and the Robson-Chapman method (mortality is increasing) was debated. For the model analysis an age-length key was used to generate missing age data for 2011.

One participant stated that they were aware of another Arctic Char fishery where age-based estimates of mortality were higher than those estimated from mark and recapture data. One reason for this may be that we assume the sample is representative of the population but this may not be the case. If the spawning component of the population, which presumably has a large component of older age classes, were not contributing to the sample taken by the fishery, this would bias the sample to make it appear as if there were fewer older age classes in the population. In years where a high proportion of spawning fish do not go out to sea, this may have an important effect on mortality estimates. It is also possible that a component of the population is not being fully sampled because they are migrating through channels in the Hornaday River delta that are not being monitored or sampled and this would also influence the calculation of mortality. One other participant noted that the large mesh size used to sample would naturally result in high mortality estimates from an age-based method like Robson-Chapman because these nets are selective for large size fish. Finally, the statistical significance of the apparent increase was questioned and participants noted that there were too few data points in recent years to confidently make a conclusion on the observed trend.

PRESENTATION 6: MONITORING TIPPITIUYAK

MONITORING OF ARCTIC CHAR FROM TIPPITIUYAK (TIPPI)

Presenter: Colin Gallagher

The fishery at Tippi was monitored in 2012 and 2013 in order to characterize the fishery and collect information on a locally described type of char called 'blue char' which is said to appear different from the Brock River and Hornaday River char called 'regular char' or 'river char'. It is thought that 'blue char' originate from elsewhere, and when compared to 'regular char' they have a smaller head, are typically longer, and have a richer flavour. In both sampling years, 'blue char' were captured more frequently than 'regular' char at Tippi and a preliminary analysis to determine if there was a difference in size structure between both types of char suggested there were none. The participants were informed that there was insufficient data to peer-review genetic characteristics of fish identified as 'blue char'.

DISCUSSION

One of the participants from Paulatuk stated that in recent years, due to climate change, it has become necessary to retrieve Arctic Char from the nets very quickly in order to prevent the flesh of the fish from becoming soft. The participant confirmed that he's observed 'blue char' in a range of sizes and that they have a smaller head and a different shape from a 'river' char. In the past it was possible to capture char that were between 18 and 20 pounds when there was ice moving back and forth from shore during early summer and when the water was cool, which has not been observed as frequently in recent years due to a warming climate. 'Blue char' have been known to be present in Darnley Bay prior to when the participant was born (he is currently considered to be an elder by the community) and that his father had taught him about 'blue char' and said that they were not from either the Brock River or Hornaday River.

PRESENTATION 7: COMMUNITY HARVEST

COMMUNITY HARVEST SURVEY RESULTS (2003-2013)

Presenter: Ellen Lea

Arctic Char harvest data was collected by individuals from the community of Paulatuk under contract to Fisheries and Oceans Canada on an annual basis between 2003 and 2013. Phone and in-person interviews were periodically conducted with harvesters between the months of August and November. The information collected provided data on the number of anadromous and landlocked char that were caught, and locations, dates or seasons fished, with the main objective to determine what the harvest of anadromous Arctic Char was relative to the voluntary harvest level recommended by the Paulatuk Char Working Group. Results from the surveys were used to document the importance of the summer fishing season, particularly at the mouth of the Hornaday River and Lasard Creek, and the multiple lakes in the Darnley Bay/ Paulatuk area used by harvesters. The reported harvest was typically less than the voluntary harvest level of 1700 fish, although harvest reporting was incomplete in some years (2004, 2005, 2007 and 2008).

DISCUSSION

The presenter confirmed that participation in the surveys was voluntary and that the confidence in the data collected was relatively high. Although some harvesters may not necessarily remember exactly how many Arctic Char they harvested over a certain period of time, which decreases the confidence or accuracy of the results, the meeting participants from the community mentioned that they believed that the numbers reported were fairly close to what was harvested. Additionally, one person mentioned that some harvesters keep track of their catches in a book, which increases the level of confidence in the numbers reported. It was confirmed that the possibility of double counting fish, whereby the char monitors and the person doing the community survey would both document the same harvest record(s) from a single person thereby producing an inflated and inaccurate harvest result, was resolved by the surveyor checking off a box on the data sheet as to whether these had already been enumerated by the char monitors. It was mentioned that the missing harvest data in 2007 and 2008 were likely a result of misplaced records that have not been located. Finally, one of the meeting participants commented that the community harvest survey was a really good program given the level of accuracy and confidence in the data as this type of information for other stock assessments in the Artic are typically lacking or inaccurate.

DEVELOPMENT OF SCIENCE ADVISORY REPORT (SAR)

The science advisory report was developed collaboratively by all participants during the meeting.

NEXT STEPS

The research documents proposed as outputs of the peer-review were confirmed by the chair of the meeting. It is noted that the information on habitat use was published in Harwood and Babaluk (2014). The chair thanked all participants for their input into the discussions and adjourned the peer review.

Reference

Harwood, L.A., and Babaluk, J.A. 2014. Spawning, overwintering and summer feeding habitats used by anadromous Arctic char (*Salvelinus alpinus*) of the Hornaday River, Northwest Territories, Canada. Arctic 67: 449-461.

APPENDIX 1: PARTICIPANTS

Name	Affiliation
Kristen Adair (Rapporteur)	Fisheries and Oceans Canada, Science
Burton Ayles	Fisheries Joint Management Committee
Robert Bajno	Fisheries and Oceans Canada, Science
David Boguski	Biodive Scientific Inc.
Colin Gallagher	Fisheries and Oceans Canada, Science
Darren Gillis	University of Manitoba, Biological Sciences
Tony Green	Paulatuk Hunters and Trappers Committee
Les Harris	Fisheries and Oceans Canada, Science
Lois Harwood	Fisheries and Oceans Canada, Science
Kimberly Howland	Fisheries and Oceans Canada, Science
Joe Illasiak	Paulatuk Hunters and Trappers Committee
Gerald Inglangasak	Fisheries Joint Management Committee
Yamin Janjua	Fisheries and Oceans Canada, Science
Ellen Lea	Fisheries and Oceans Canada, Fisheries Management
Michael Papst	Fisheries Joint Management Committee
Ross Tallman	Fisheries and Oceans Canada, Science
Melanie Toyne	Fisheries and Oceans Canada, Science
Margaret Treble (Chair)	Fisheries and Oceans Canada, Science
Xinhua Zhu	Fisheries and Oceans Canada, Science

APPENDIX 2: TERMS OF REFERENCE

Assessment of Arctic Char in the Darnley Bay area of the Northwest Territories

Regional Peer Review – Central and Arctic Region
February 6-7, 2014
Winnipeg, MB

Chairperson: Margaret Treble

Context

Anadromous Arctic Char (*Salvelinus alpinus*) are an important subsistence resource for the residents of Paulatuk, NT, with the majority of the harvest occurring in the marine waters along the eastern shores of Darnley Bay during the summer. Arctic Char from the Hornaday River are the most important stock for Paulatuk harvesters, and harvests traditionally occurred at the mouth of the river during the char's upstream migration in August. A decline in the char harvests in this area prompted the establishment of the Hornaday River Char Monitoring Program in 1990. Two harvesters from Paulatuk collect harvest, catch-effort and biological data from the fishery during August. The program has occurred annually since its inception and the data are used to examine evaluate stock status and trends, including relative abundance and population demographics. The last formal stock assessment was conducted in 1999, incorporating monitoring and research data available up to and including 1998. That assessment indicated improvements in population metrics relative to the late 1980s, a time of diminishing subsistence and commercial catches, and reduced size of individual fish. The Paulatuk Char Management Plan, ratified in 1998, recommended the total annual harvest of 1,700 Arctic Char from the Hornaday River which has remained unchanged since.

In recent years, residents of Paulatuk have been shifting more of their fishing effort for Arctic Char north-eastward in Darnley Bay to a coastal area at the mouth of Lasard Creek, near the mouth of the Brock River. This system also supports a smaller putative stock of anadromous Arctic Char. The extent of mixing between char from the Hornaday and the Brock systems is not known, although a tag return in 1996 did confirm movement of fish between the two systems. In 2011, monitoring efforts were expanded to include this area as well. Although Arctic Char are still harvested at the mouth of the Hornaday River in summer and in the river itself in fall/winter it is unclear to what extent the shift in harvest location alters the harvest rate of Arctic Char originating from both rivers. This uncertainty is compounded by the lack of information on the discreteness of these stocks, the degree of mixing between them, and the possible contribution of any other stocks to the harvest. To inform management of Arctic Char, an updated population assessment of the Hornaday will need to consider the change in fishing areas and potential for a mixing of stocks in the fishery.

Currently, the Paulatuk Hunters and Trappers Committee and Paulatuk Char Working Group have requested an increase in harvest to meet the subsistence needs of the community. As a result, Fisheries and Oceans Canada Resource Management has requested Science advice on the current stock status and sustainable harvest level of Arctic Char from the Hornaday River, and information on the contribution of putative stocks to the harvests at important fishing locations during the summer.

Objectives

The objectives of this meeting is to undertake a science-based peer review of all available information relevant to providing advice on the sustainable harvest level for Arctic Char from the Hornaday River. Specifically the meeting will address the following objectives:

1) examine trends in the catch-effort and biological data collected at the mouth of the Hornaday River between 1990 and 2013 by the Hornaday Char Monitoring Program;
2) compare the results from the Hornaday Monitoring Program with the recently established monitoring program at Lasard Creek;
3) determine whether Arctic Char from the Hornaday and Brock rivers are separate stocks and examine their current contribution to the harvest at the Hornaday and Lasard Creek coastal fishing locations;
4) incorporate total harvest, catch-effort and biological time-series data from the Hornaday River for a surplus production modelling exercise to estimate the population abundance and sustainable harvest level, and associated risk levels, for Arctic Char from the Hornaday River;
5) present baseline genetic information on the contribution of Arctic Char that may not originate from either Hornaday or Brock rivers to the harvest in Darnley Bay (i.e., "Blue Char"); and
6) discuss future research needs and current monitoring plans for Arctic Char in Darnley Bay.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Documents

Participation

- Fisheries and Oceans Canada (DFO) (Ecosystems and Oceans Science, and Ecosystems and Fisheries Management sectors)
- Fisheries Joint Management Committee
- Academics
- Paulatuk Hunters and Trappers Committee
- Other invited experts

APPENDIX 3: AGENDA

Regional Advisory Process

Assessment of Arctic Char from Darnley Bay, Northwest Territories

February 6 and 7, 2014

Fisheries and Oceans Canada
Freshwater Institute (small seminar room)
501 University Crescent, Winnipeg, MB
Chair: Margaret Treble

February 6

9:00-9:15	Introductory remarks	M. Treble
	Review of Terms of Reference	
9:15-9:45	Arctic char in Darnley Bay: background	C. Gallagher
9:45-10:30	Surplus production/ age structured models (ToR #4)	X. Zhu
10:30-10:45	Break	
10:45-12:00	Surplus production/ age structured models (ToR #4)	X. Zhu
12:00-13:15	Lunch	
13:15-13:45	Spawning, overwintering and summer feeding habitats used by anadromous Arctic char of the Hornaday River, Northwest Territories, Canada	L. Harwood
13:45-14:45	Genetic stock identification and mixed-stock fishery analysis of Arctic char in Darnley Bay, Northwest Territories (ToR #3)	D. Boguski
14:45-15:00	Break	
15:00-16:30	Harvest, catch-effort and biological information of Arctic Char from subsistence monitoring programs (ToR #1, 2)	C. Gallagher

February 7

9:00-10:30	Harvest, catch-effort and biological information of Arctic Char from subsistence monitoring programs (ToR #1, 2)	C. Gallagher
10:30-10:45	Break	
10:45-12:00	Harvest survey results	E. Lea
12:00-13:15	Lunch	
13:15-14:45	Future research needs (ToR #6)	M. Treble
14:45-15:00	Break	
15:00-16:30	Develop conclusions/ advice for the Science Advisory Report & conclude meeting.	M. Treble